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1.0 PURPOSE AND SCOPE

This procedure describes the steps and requirements for controlling testing activities performed to ensure that items meet established design, performance, and quality requirements as part of the Tank Farm Contractor Work Control (see TFC-OPS-MAINT-C-01). This procedure applies to structures, systems, components, or equipment procured for use or operated within CH2M HILL Hanford Group, Inc. (CH2M HILL) scope of work. (7.1.1)

This procedure does not apply to routine post-maintenance testing, routine system compliance or functional testing, start-up/operational acceptance testing, routine radiation or other environmental/ surveillance activities.

2.0 IMPLEMENTATION

This procedure is effective on the date shown in the header.

3.0 RESPONSIBILITIES

Responsibilities are contained within Section 4.0.

4.0 PROCEDURE

Post-maintenance testing is performed at operations facilities to ensure that repaired or replaced equipment is functional.

4.1 Test Planning

Responsible Engineer

1. Identify item(s) to be tested and the test requirements as part of the Tank Farm Contractor work control process (see TFC-OPS-MAINT-C-01). In determining test requirements, the Supplementary Requirements for Test Control (Attachment A) are intended as a partial checklist of things to consider for inclusion, using a graded approach.

   NOTE 1: For post-maintenance testing (see TFC-ENG-STD-08 for requirements for this type of testing.)

   NOTE 2: Requirements for identifying the test status shall be in accordance with TFC-ESHQ-Q_INSP-C-04.

2. Establish characteristics to be tested based on specified test requirements and acceptance criteria contained in applicable design documents, codes, specifications, standards, or other technical documents.

3. Approve changes to the approved configuration of a facility prior to performing the test, if required for testing purposes.

4. Identify the need for conducting test reviews, as appropriate, before, during, and after testing to confirm identified test requirements, ensure proper test performance, and verify the results of the conducted tests.

   a. Determine, using a graded approach, the type and extent of test reviews based on the scope, complexity, and risks associated with the testing program.

   b. Use representatives from engineering, operations, safety, quality assurance, and the customer, as appropriate, on the review team.

      NOTE: Conduct test reviews to:

      - Ensure understanding of the pretest documentation and material requirements before testing
      - Ensure that sufficient data have been obtained to proceed with the next phase of testing activities.

   c. Confirm test results, confirm that the test meets established requirements, and ensure acceptability of the tested items.

4.2 Test Plans

Responsible Engineer

1. If the test is not a production/process test, go to step 5.

Responsible Engineering Manager

2. If the test does not warrant preparation of a process control plan (in consultation with operations/project management), go to step 5.

Responsible Engineer

3. Prepare a process control plan in accordance with TFC-ENG-CHEM-C-11 in lieu of a test plan.

4. Terminate the activity.

5. Prepare a test plan as a supporting document in accordance with HNF-IP-0842, Volume 4, Section 4.26 (see TFC-PRJ-SUT-C-01 for test plan guidance).

4.3 Testing Procedures

Responsible Engineer

1. Prepare, review, and approve test procedures in accordance with TFC-OPS-OPER-C-13. Where appropriate, use RPP, vendor, and industry test procedures (e.g., leak tests, calibration, NDE, proof tests, etc.), and consider the checklist items in Attachment B.

2. Include in the test procedure or other work document:

   - Test prerequisites to address the item to be tested, calibrated instrumentation, appropriate equipment, pre-test configuration, including suitable environmental conditions, personnel training, qualification level of personnel performing tests, condition of test equipment, provisions for data acquisition, and safety barriers.

   - Types of equipment to be used (e.g., instruments, tools, gauges, reference and transfer standards, and nondestructive examination equipment), including required precision and accuracy

   - Conditions under which retesting is permitted or required

   - Provisions for resolution of test procedure issues when performing acceptance tests

   - Methods for documenting test data, data analysis, and accept/reject status of test

   - Post-test conditions, if applicable.

3. Write test procedures to allow flexibility in test performance to include the following, as appropriate:

   - Provisions for performing testing of or within individual sections of the test procedure independently of other sections

   - Provisions for changing the order in which the testing sections are performed to facilitate field conditions and efficiency

   - Mandatory acceptance criteria which are clearly differentiated from requirements for informational test data

   - Identification of testing sequences where the results of a test establishes operating parameters for a subsequent test.

3. Include or reference test objectives, test method to be employed, instructions for performing the test, evaluation of test results, and acceptance criteria, provisions for assuring that prerequisites for a given test have been met, that adequate instrumentation is available and used, that necessary monitoring is performed, and that suitable environmental conditions are maintained before beginning the test.

   NOTE: In lieu of specially prepared written test procedures, appropriate sections of related documents, such as industry standards, supplier manuals, equipment maintenance instructions, or approved drawings or travelers with acceptance criteria, can be used.

Such documents must include adequate instructions to assure the quality of work, and must specify the manner and application of their use.

4. Specify the following, as applicable, in test procedures for testing of programs used for operational control:

   - Required tests and test sequence
   - Required ranges of input parameters
   - Identification of the stages at which testing is required
   - Criteria for establishing test cases
   - Requirements for testing logic branches
   - Requirements for hardware integration
   - Anticipated output values
   - Acceptance criteria
   - Reports, records, standard formatting and conventions.

5. Ensure the test procedures or other test documents are evaluated in accordance with TFC-ENG-SB-C-03 if the test is to be performed in the facility.

6. Issue new test procedures or other test control documents in accordance with TFC-ENG-ADMIN-C-01.

7. Issue revised test procedures or other test control documents in accordance with TFC-ENG-DESIGN-C-06.

4.3 Construction Acceptance Test Exceptions

Responsible Engineer

1. Go to step 10 if an issue arises while performing the test procedure that impacts test acceptance criteria.

2. Generate a test exception for construction acceptance tests if an issue arises when performing the test procedure.

3. Assign a test exception number to the test exception (see A-6003-787).

4. Mark the acceptance test procedure step (where the issue arose) by red line to identify the test exception number and resolution, if possible.

5. Document the resolution to the issue on a test exception form (see A-6003-788).

6. Approve the test exception form.

Test manager/director

7. Approve the test exception form.

8. If the test is being performed in the facility, and the test procedure is subject to USQ process, ensure that the exception is evaluated in accordance with TFC-ENG-SB-C-03.

8. Perform the affected portion of test.

9. Terminate the exception activity.

Responsible engineer

10. Process test acceptance criteria changes by issuing an Engineering Change Notice in accordance with TFC-ENG-DESIGN-C-06.

4.4 Test Results

Responsible Engineer

1. Document test results using a graded approach that include:

- Item or work product tested
- Date of test
- Name of tester(s) (individual(s) performing the test) and data recorders
- Identification of test criteria or reference documents used to determine acceptance
- A description of any known conditions that adversely affected the results of the test
- Results and acceptability of the test
- Identification of measuring and test equipment used during the test, recording the unique identification number and calibration due date when applicable
- Any deviation experienced during conduct of the test and the action taken in connection with the noted deviation
- Test exceptions that were encountered during construction acceptance tests and any impacts to the system/component(s) under test
- Name and signature of the person evaluating the test results and the date the evaluation was complete
- Nonconforming items and controls

2. Issue new test results in accordance with TFC-ENG-ADMIN-C-01.

3. Issue revised test results in accordance with TFC-ENG-DESIGN-C-06.

5.0 DEFINITIONS

Operations and Maintenance testing is typically divided into six categories: 1) development testing; 2) qualification testing; 3) post-modification testing; 4) operational testing; 5) production/ process testing; and 6) post-maintenance testing.

Development testing. Testing that provides or develops design information, concepts, or criteria. Development testing may also verify design, safety, or reliability concepts or criteria. It may also develop performance characteristics through the use of mock-ups or test facilities, develop engineering specification requirements and specific design objectives, or resolve engineering or technical issues.

Qualification testing. Testing (including prototype qualification testing and proof testing) performed to verify adequacy of design. Qualification testing demonstrates adequacy of performance under conditions that simulate the most adverse design conditions, operating modes, and environmental conditions. When tests are performed on models or mock-ups, scaling laws must be established and verified. Error analyses of the results of model tests should be considered before the results are used in final design.

Post-modification testing. Testing performed to ensure that equipment with minor modifications will perform its design function and that no other equipment has been affected by the modification in a manner that would inhibit its ability to perform its design function.

Operational testing. Testing performed to verify that functional, operational, and design requirements have been met. The tests are performed with the structures, systems, components, and interfaces in their final in-service configuration and may include both normal and off-normal conditions. Relatively standard structures, like simple piping systems and other non electro-mechanical systems, typically do not require operational testing. Operational testing is normally performed by the RPP facility operator (see TFC-PLN-26).

Post-maintenance test. A test that is performed on structures, systems, and components to determine whether corrective maintenance, preventive maintenance, modification, testing, or troubleshooting activities have affected the ability of the equipment and its associated interfaces/equipment to perform their intended function. In the case of corrective maintenance, a post maintenance test also verifies that the maintenance action has properly corrected the identified deficiency.

Production/process testing. Testing performed to evaluate potential improvements, develop optimum process parameters, or establish new criteria at operating facilities. The testing generally consists of making a controlled change in a production or processing operation (see TFC-ENG-CHEM-C-11).

6.0 RECORDS

The following records are generated during the performance of the procedure:

- Test Plans.

The responsible Engineering manager is responsible for record retention and retirement in accordance with TFC-BSM-IRM_DC-C-02.

7.0 SOURCES

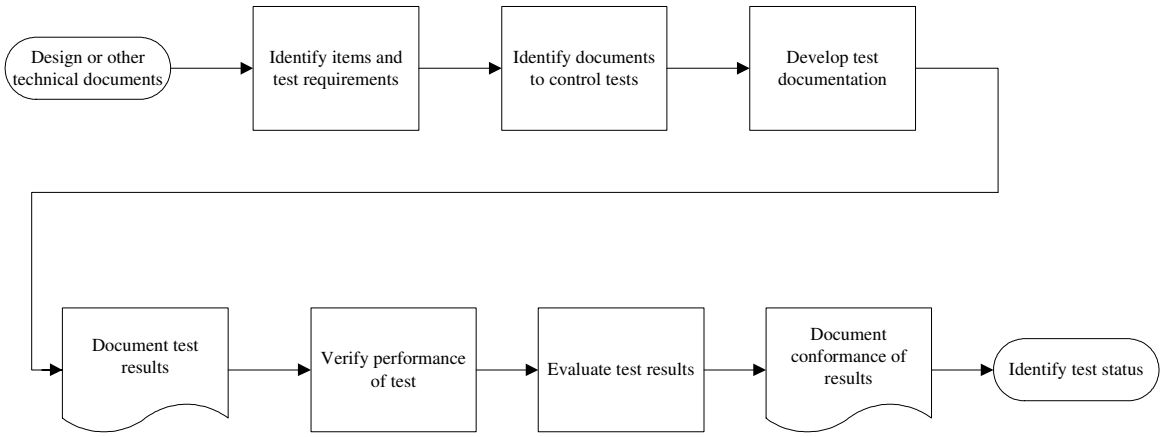
7.1 Requirements

1. TFC-PLN-02, "Quality Assurance Program Description."

7.2 References

1. HNF-IP-0842, RPP Administration, Volume 4, Section 4.26, "Supporting Document Requirements."
2. TFC-BSM-IRM_DC-C-02, "Records Management."
3. TFC-BSM-IRM_HS-C-01, "Software Development, Implementation, and Management."
4. TFC-ENG-ADMIN-C-01, "Engineering Data Transmittal Process."
5. TFC-ENG-CHEM-C-11, "Process Control Plans."
6. TFC-ENG-DESIGN-C-06, "Engineering Change Control."
7. TFC-ENG-SB-C-03, "Unreviewed Safety Question Process."
8. TFC-ENG-STD-08, "Post Maintenance Testing."
9. TFC-ESHQ-Q_INSP-C-04, "Inspection and Test Status Indicators."
10. TFC-OPS-OPER-C-13, "Technical Procedure Control and Use."
11. TFC-OPS-MAINT-C-01, "Tank Farm Contractor Work Control."
12. TFC-PLN-26, "Start-up and Testing Program Plan."
13. TFC-PRJ-SUT-C-01, "Test Plan Preparation."

Figure 1. Test Control Flowchart.



ATTACHMENT A - SUPPLEMENTARY REQUIREMENTS FOR TEST CONTROL

In determining test requirements, the bulleted items that follow are intended as a partial checklist of things to consider for inclusion using a graded approach:

- Requirements for test documentation necessary to support the testing
- Methods to control the release and revision of test documentation
- Methods to ensure that test documents are transmitted to the LMSI Document Processing Center for storage in an approved records storage facility
- Quantitative or qualitative acceptance criteria for determining the acceptability of the test results
- Requirements for measurement and test equipment calibration
- Requirements for identification, training, and qualification of test personnel
- Requirements for facility identification, status, and condition
- Requirements for safety and hazards analysis
- Requirements for administration of safety
- Requirements for test program mandatory hold points, verification, and witness points
- Rationale for the methods, extent, and schedule of tests to be conducted
- Requirements for the development of test specifications by the applicable Engineering organization for use by the testing organization
- Requirements for managing interfaces of structures, systems, and components to be tested
- Requirements for managing the interfaces between organizations involved in the testing
- Requirements for training and qualification of test personnel
- Responsibilities, duties, and authorities of the personnel involved in the testing
- Requirements for troubleshooting and corrective maintenance
- Requirements for controls for non-conforming items and retest
- Requirements for appropriate test reviews

ATTACHMENT A - SUPPLEMENTARY REQUIREMENTS FOR TEST CONTROL (cont.)

- Requirements for software tests - software used for operational control must be tested to demonstrate required performance over the range of operation of the function or process being controlled

  NOTE 1: Software must be qualified for use in accordance with TFC-BSM-IRM_HS-C-01.

  NOTE 2: When installed on different computers or when significant hardware or operating system configuration changes are made, software requires retest.

- Requirements for handling test suspensions/interruptions and subsequent restarts

- Requirements for the use of standard industry test procedures, where appropriate, and what, if any, site and RPP-specific safety considerations are necessary to augment the standard tests.

ATTACHMENT B - CHECKLIST OF ITEMS TO CONSIDER FOR TEST PROCEDURES

NOTE: This checklist is intended as a guide and is not an exhaustive list of everything that may or should be considered.

✔	ITEM to CONSIDER or ADDRESS	COMMENT
	Desired results	
	Parameters to be measured and precision required	
	Expected range of results and acceptance criteria (ensure that minimum expected values are included to allow zero values due to instrument/equipment/test problems to be highlighted and investigated prior to proceeding with the test.)	
	Method of data collection (manual, electronic, strip chart, logbook, photographic, etc.)	
	Hold Points requiring evaluation or verification	
	Test abort criteria and test restart criteria	
	Independent witness or verification of readings, or results	
	Potential test failure modes and affects	
	Potential hazards: • Industrial • Radiological • Chemical • Criticality • Fire • Environmental	
	Effect of environmental conditions on test	
	Environmental permits	
	Authorization Basis (Unreviewed Safety Question)	
	Instrument uncertainty and accuracy	
	Operating Specification Limits and any required deviations/ revisions	

ATTACHMENT B - CHECKLIST OF ITEMS TO CONSIDER FOR TEST PROCEDURES (cont.)

✔	ITEM to CONSIDER or ADDRESS	COMMENT
	Special equipment required, including spare parts	
	Test equipment required and calibration	
	Availability of vendor manuals for operation, maintenance, and troubleshooting equipment	
	Allowable maintenance and troubleshooting during test	
	Disposal of special test equipment, or material	
	How to confirm proper function of all existing equipment affected by modification, repair, or replacement	
	Sequence of test steps	
	Prerequisite lineups of mechanical, electrical, and instrumentation systems (e.g., valves, breakers, transmitters, sensing lines)	
	Control of interfaces of system being tested with other plant systems, such as: • Electrical • Water • Sewer • Compressed air • Instrumentation • Alarm.	
	Post-test lineups of mechanical, electrical, and instrumentation systems (e.g., valves, breakers, transmitters, sensing lines)	
	Personnel required to conduct test	
	Support personnel required for test	
	Training of personnel	